VIRGINIA DIVISION OF MINERAL RESOURCES

PUBLICATION 153

COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1998

Palmer C. Sweet and Jack E. Nolde

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
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Stanley S. Johnson, State Geologist

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FRONT COVER: Quarry in greenstone of the Catoctin Formation, Charlottesville Plant of Luck Stone Corporation, view to the west-southwest.

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COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1998

Palmer C. Sweet and Jack E. Nolde

INTRODUCTION

The total value of mineral production in Virginia in 1998 was almost 1,688.64-million dollars (Table 1; Figure 1). About 883.96-million dollars resulted from coal sales, a 7.84-percent decrease in value from the 1997 figure of 959.12-million dollars. About 124.957-million dollars was produced from the sale of crude oil and natural gas, with the remaining 679.72-million dollars from production of industrial rocks and minerals (Tables 2, 3, and 4). The total value represents a 13.94-million dollar decrease for 1998, when compared with 1997. The value of crushed stone was up 11.3 percent, the value of lime was up 6.6 percent, and the value of sand and gravel was down $200,000.

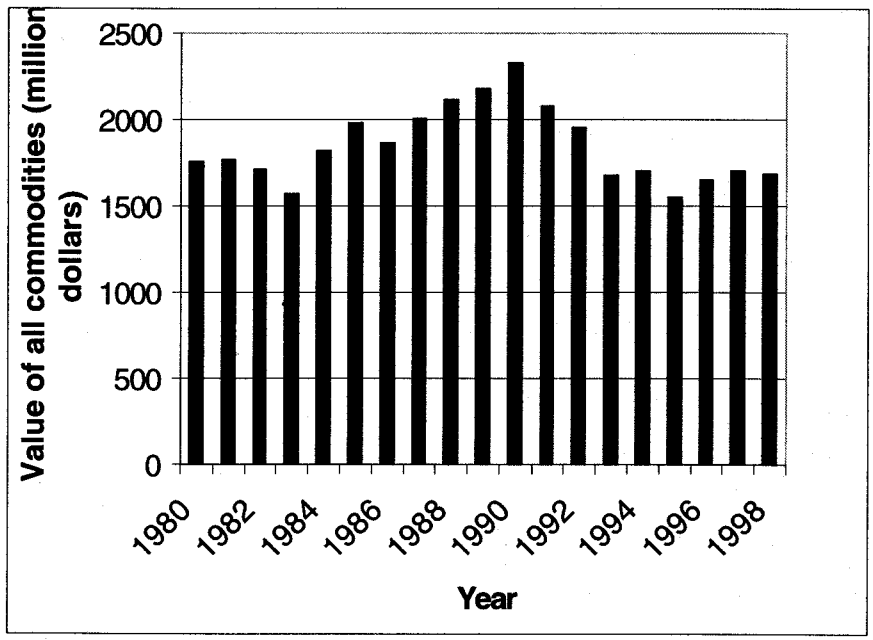


Figure1. Total value of mineral production in Virginia, 1980-1998

Crude oil production was down 6.7 percent, while natural gas production was up almost 7.8 percent. On a slight increase was the production of clay materials. Virginia led the nation in the production of kyanite; was the only producer of a feldspar, marketed as "Virginia aplite"; and was one of two states mining vermiculite. Virginia also ranked fifth in crushed stone production, ninth in lime production, and 29th

Table 1. Mineral resource production in Virginia, 1998.

Mineral Commodity		Quantity	Value (thousand)
Clay[1]	short tons	846,000	$3,220
Coal (bituminous)[2] ($26.00/short ton))	thousand short tons	33,998	$883,960
Lime[1]	thousand short tons	848	$49,500
Natural Gas[2] ($2.25/Mcf)	million cubic feet	55,467	$124,802
Petroleum[2] ($16.06/barrel)	42-gallon barrel	9,646	$154
Sand and Gravel[1]	thousand short tons	10,600	$54,000
Stone:			
Crushed[1]	thousand short tons	73,600	$442,000
Combined value of cement, clay (Fuller's earth), dimension stone, feldspar, gemstones, gypsum, industrial sand and gravel, iron oxide pigments, kyanite, sulfur, titanium and zirconium concentrates, and vermiculite[1]		XX	$131,000
Total		XX	$1,688,636

XX, Not Applicable

[1] Measured by mine shipments, sales, or marketable production (includes consumption by producers)- from U.S. Geological Survey

[2] Virginia Department of Mines, Minerals and Energy

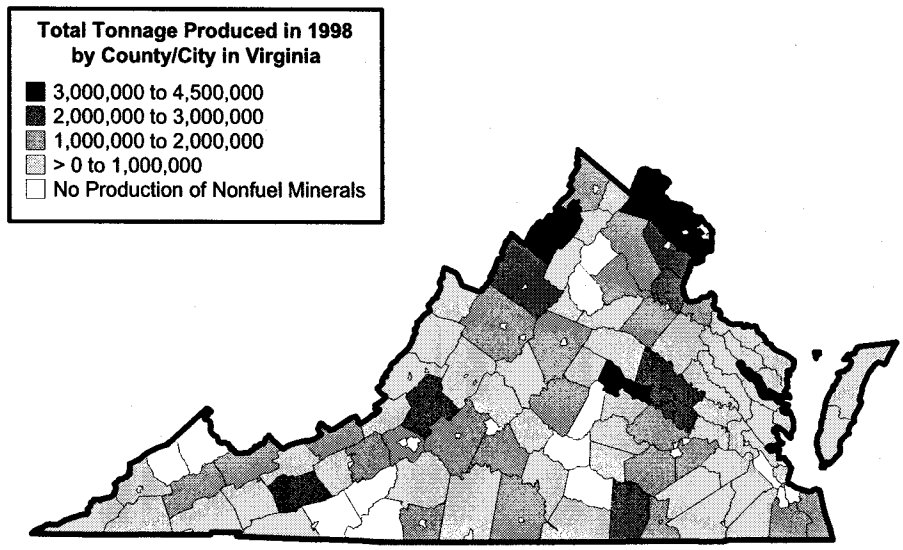


Figure 2. Total tonnage of non-fuel mineral resource production, 1998

in the production of sand and gravel. Granite was the most extensively mined nonfuel material in 1998, followed by limestone, traprock, sand and gravel, and sand. These five mineral commodities accounted for 89.6 percent of the total nonfuel mineral production in 1998. Several mineral commodities, including iron oxide, manganese, mica, perlite, and phosphate rock were imported for processing.

The number of producers and the number of processing plants remained constant during the year for cement, feldspar, gemstones, gypsum, industrial sand, iron-oxide pigments, kyanite, ornamental aggregate, sand and gravel, and vermiculite.

INDUSTRIAL AND METALLIC COMMODITIES

Industrial minerals and rocks, other than mineral fuels, were produced in a total of 89 Virginia counties/cities in 1998 (Figure 2). The five leading counties for 1998 in industrial minerals and rocks were Loudoun, Goochland, Fairfax, Shenandoah, and Henrico Counties; these counties produced 21.5 percent of the 1998 production. The combined value of all nonfuel commodities sold in 1998 was 679.72-million dollars. In 1998, 233 companies operated 347 industrial-mineral mining operations. Eighteen of the 233 companies produced more than one mineral commodity from 86 operations. These eighteen companies produced 53,664,156 short tons of industrial minerals, or 61.5 percent of the total production. Of the 86 multiple industrial-mineral operations, 1 operation produced basalt, 2 operations produced clay, 1 operation produced diabase, 1 produced dolomite, 1 operation produced feldspar, 30 operations produced granite, 1 operation produced gravel, 1 operation produced greenstone, 11 operations produced limestone, 1 operation produced marl, 1 operation produced quartz, 1 operation produced quartzite, 8 operations produced sand, 9 operations produced sand and gravel, 3 operations produced sandstone, 7 operations produced shale, 2 operations produced slate, and 5 operations produced traprock.

The total average annual employment reported in 1998 for industrial mineral and rock operations were 4,820 individuals. Industrial mineral and rock production employees worked an average of 234 days in 1998. Total wages of $128,754,170 were paid to a total of 4,820 employees (4,087 production employees and 733 nonproduction employees). The average annual wage earned by all employees was $26,712 based on those employees for whom wages were reported. The average annual wage for production employees was $25,954 and for nonproduction employees was $30,942.

CEMENT

Three companies produce cement in Virginia. Roanoke Cement Company operates a plant in western Botetourt County and manufactures portland cement from locally mined limestone and shale and purchased iron scale from Roanoke Electric Steel Company. Calcium and iron-aluminate-clinker is manufactured in five coal-fired kilns and ground into cement. Three-fourths of the cement is sold to local ready-mix companies. The Riverton Corporation in Warren County produces masonry cement at its plant north of Front Royal. Limestone from the Edinburg Formation is crushed, calcined, hydrated, and mixed with portland cement from out-of-state sources to produce masonry cement that is sold to building supply dealers in Virginia and surrounding states. LaFarge Calcium Aluminate, Inc. operates a cement manufacturing plant in the City of Chesapeake using imported cement clinker from France. The clinker is ground and made into six types of calcium-aluminate cement at the facility. The advantages of this cement include rapid hardening, resistance to wear and corrosion, and it can be used under a wide range of temperatures.

CLAY MATERIALS

Residual and transported clay, weathered phyllite and schist, and shale are used as raw material to produce bricks in Virginia. The U.S. Geological Survey reports 846,000 short tons of clay was produced in Virginia in 1998 (Figure 3). Eleven companies at 11 operations in 6 counties during 1998 produced clay. Clay material production in Botetourt, Brunswick, and Orange accounted for 41.5 percent of the total production of clay (exclusive of fuller's earth) in Virginia (Figure 3). The annual total capacity of all brick plants in the Commonwealth is almost one-half-billion bricks. The clay material industry in the western part of the state mines Paleozoic-age shale primarily to produce face-brick. Face-brick producers, in the central-to-eastern part of Virginia, mine Triassic-age shale and clay residuum in Orange and Prince William Counties. They also mine Precambrian-age schist and residual and transported clay in Amherst, Brunswick, Chesterfield, and Greensville Counties.

Lightweight aggregate is produced in Buckingham and

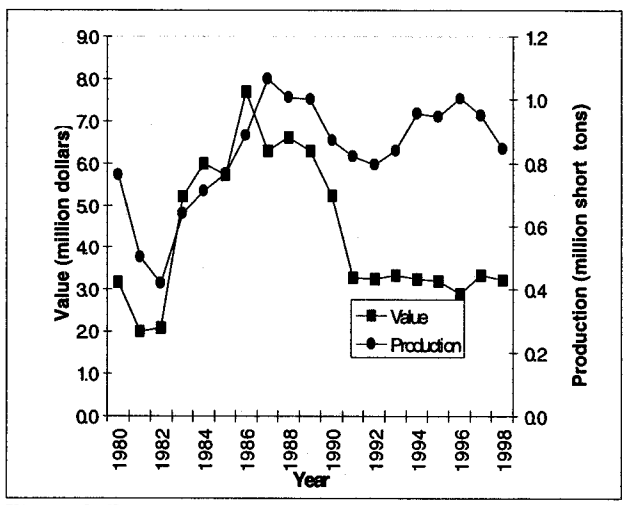


Figure 3. Trend in clay material production and value, 1980-1998.

Pittsylvania Counties. Solite Corporation, in northern Buckingham County, uses the Arvonia Slate to produce lightweight aggregate. Virginia Solite Company mines Triassic-age shale southwest of Danville in Pittsylvania County, to produce a similar product.

Bennett Mineral Company, in the Walkerton area of King and Queen County, in eastern Virginia, mines and processes montmorillonite (smectite) clay to produce an industrial and sanitary absorbent. The facility uses wood waste as a fuel to dry the clay in a rotary kiln. The Golden Cat plant of Ralston Purina, located near Manquin, King William County, began producing cat litter in the summer of 1997. Brands of cat litter produced include Tidy Cat, Tidy Scoop, and Scamp. More than 56,943 short tons of montmorillonite clay (fuller's earth) were mined for production of cat litter in the Commonwealth during 1998.

CONSTRUCTION SAND AND GRAVEL

Construction sand and gravel producers accounted for 10.6 million short tons of material in 1998 at a value of 54 million dollars (Figure 4). Eight companies at 8 operations in 5 counties during 1998 produced gravel. Gravel production totaled 70,321 short tons. Sand was produced by 102 companies at 121 operations in 43 counties/cites during 1998; Chesapeake (City), Isle of Wight, and Virginia Beach (City) accounted for 66.3 percent of the total production. Sand and gravel was produced by 47 companies at 67 operations in 28 counties during 1998; Henrico, King George, and Prince George Counties account for 50.6 percent of the total production. The construction sand and gravel production figures were almost 15.2 percent lower than in 1997. Sand and gravel are extracted from river terraces and dredged from the rivers in eastern, central, and western Virginia. Some construction sand is also produced from Carroll, Craig, Rockbridge, Smyth, and Warren Counties in the western part of the State, in the Blue Ridge and Valley and Ridge provinces. Large tonnages of construction sand and gravel, from southeast of Fredericksburg, are shipped by rail to the northern Virginia-Washington,D.C. market area. A large portion of the production by the Tidewater Quarries, Inc. and Tarmac Mid Atlantic, Inc., near Richmond is barged down the James River to the Norfolk area. Masonry and concrete sand are produced in the Cities of Chesapeake and Virginia Beach (Figure 5). Rail and truck also make shipments to the western part of the Commonwealth. Construction sand (concrete and masonry) is also produced from operations that crush and process sandstone.

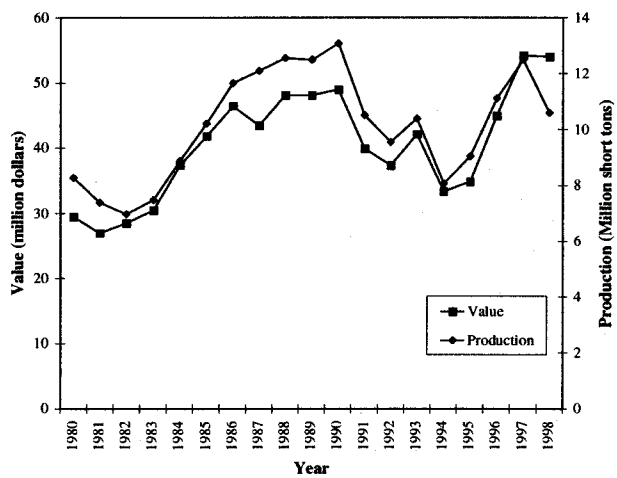


Figure 4. Trend in sand and gravel production and value, 1980-1998.

CRUSHED STONE

About 73.6 million tons of crushed stone including limestone, dolostone, sandstone, quartzite, granite, gneiss, diabase, basalt, greenstone, slate, "Virginia aplite," and marble, were produced in Virginia in 1998 (Figure 6). Virginia's crushed stone production was valued at 442 million dollars and it was the fifth leading producer in the United States. Crushed stone production figures for 1998 in Virginia were 12.2 percent higher than figures for 1997.

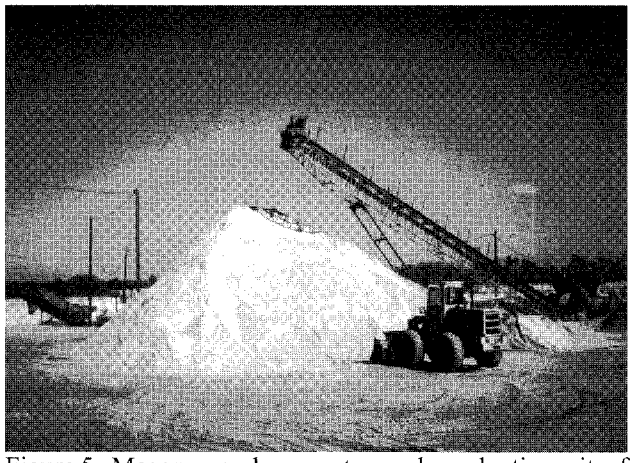


Figure 5. Masonry and concrete sand production pit of Baillio Sand Co., Inc., City of Virginia Beach.

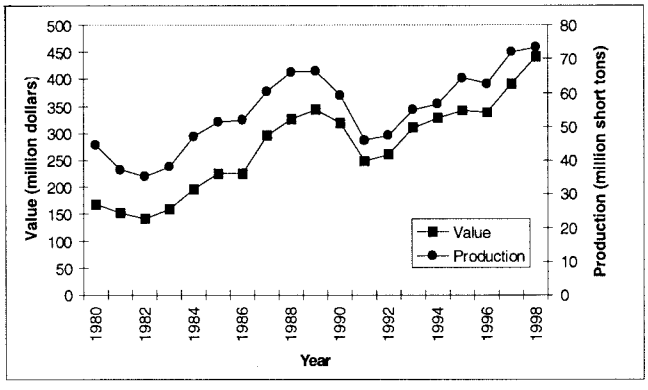


Figure 6. Trend in crushed stone production and value, 1980-1998.

Producers of limestone, dolostone, shale, sandstone, and quartzite are in the Blue Ridge, Valley and Ridge, and Appalachian Plateaus provinces in the western part of the Commonwealth (Figure 7). Principal end uses for these commodities were for roadstone, concrete aggregate, asphalt stone, and agricultural application. Mine safety dust is produced in southwest Virginia from limestone. Safety dust is used in coal mines to coat the roof, walls, and floor to prevent coal dust explosions. The safety dust should contain less than 5 percent SiO_2 and 100 percent should pass 20 mesh, with 70 percent passing 200 mesh. Several operations also market finely ground dolostone and limestone for use as a filler material.

Shale is excavated in Frederick and Rockingham Counties for use as local roadstone and fill material. Sandstone and quartzite are quarried in Carroll, Culpeper, Pittsylvania, Rockbridge, and Wythe Counties for production of roadstone, concrete aggregate, asphalt stone, and manufactured fine aggregate (Figure 8).

Granite, gneiss, diabase, greenstone, slate, and marble are quarried in the central part of Virginia. Major uses of these materials are for roadstone, concrete aggregate, and asphalt stone. The Solite Corporation crushes slate for lightweight aggregate near Arvonia in Buckingham County.

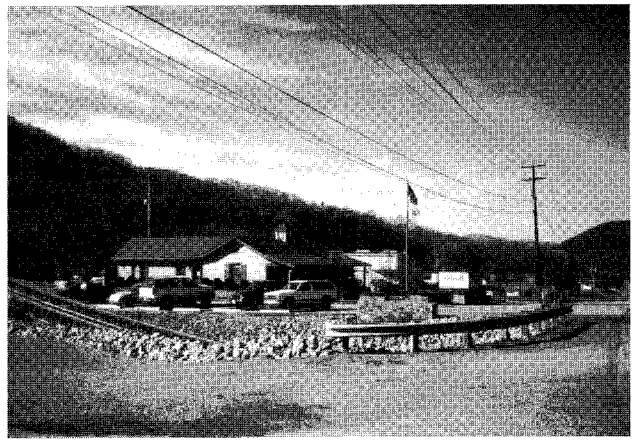


Figure 7. Main office of W.W. Boxley Co., Blue Ridge Plant, Bedford County.

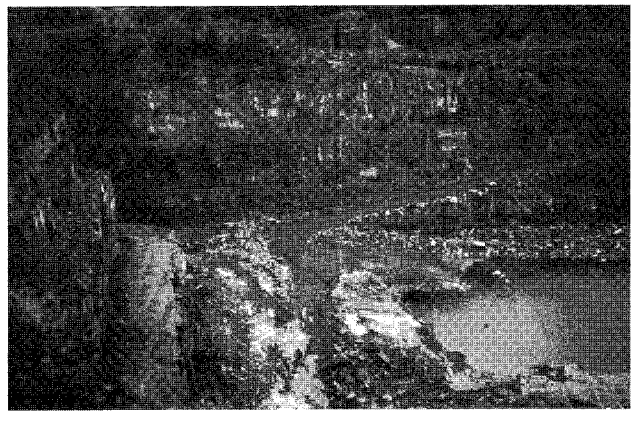


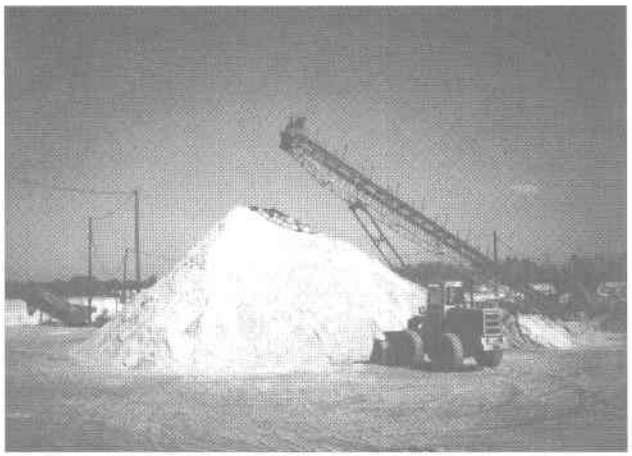
Figure 8. Quarry in Mesozoic sandstone, Martin Marietta Materials, Culpeper County.

LeSueur-Richmond Slate Corporation increased production of crushed slate, as a by-product of dimension slate operations, for roofing granules and local highway construction. Appomattox Lime Company, Inc. quarries marble (Mt. Athos Formation) near Oakville in Appomattox County for agricultural lime.

Fines produced at quarries in the Petersburg and Red Oak Granites, in the southern part of Virginia have been used for low-grade fertilizer. Chemical analyses of these granitic materials from Brunswick and Nottoway Counties in the southern Piedmont province show a K_2O (potash) content higher than 10 percent. Potassium-aluminum feldspars (orthoclase and microcline), common in igneous and metamorphic rocks, release potassium upon weathering. Additional uses for these fines are for roads, bedding for concrete pipe, bedding for plastic liners in landfills, and for warning tracks for baseball fields.

DIMENSION STONE

Slate, diabase, quartzite, and soapstone were quarried for dimension stone in the Piedmont province in 1998. Slate was the leading type of dimension stone quarried, in terms of cubic feet and value; LeSueur-Richmond Slate



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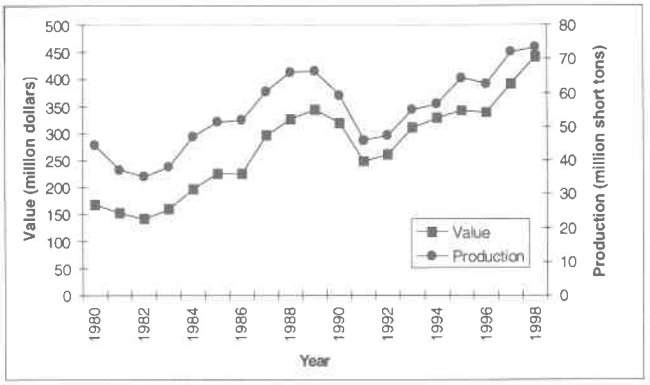

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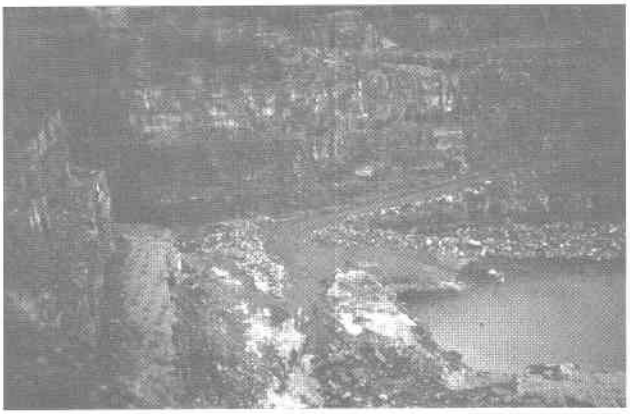

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Corporation mines slate from two quarries in the Arvonia area of Buckingham County. Arvonia slate production dates from the late 1700s when slate was quarried for use as roofing shingles for the state capital in Richmond. Slate producers supply the building trade with a variety of products ranging from material for exterior applications, such as roofing shingles and granules and for flooring tile, hearths and sills. Diabase is produced by New England Stone, Virginia Black Granite, and Cedar Mountain Stone in southern Culpeper County for use as monument stone and other ornamental uses (Figure 9). The quarried blocks are trucked to South Carolina and Georgia finishing plants; some stone is exported out of South Carolina ports to overseas markets. Quartzite used as flagging material was extracted from the Mower Quarry in Fauquier County, north of Warrenton.

New World Stone Company purchased the soapstone plant of Tulikivi, Inc. in Schuyler, Nelson County, in November 1998. The company plans to produce special order soapstone products, mainly from blocks on the site.

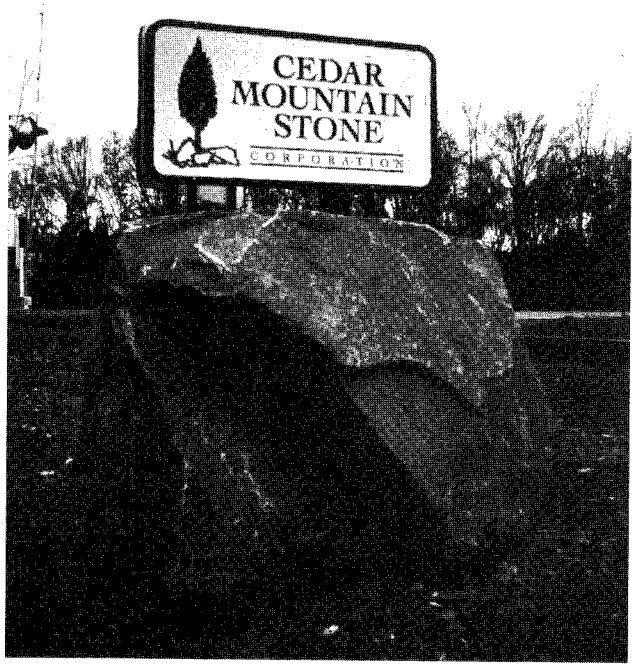

Figure 9. Stone quarry of Cedar Mountain Stone, Culpeper County.

FELDSPAR

About 610,530 tons of feldspar was mined in Virginia during 1998 from Amherst and Hanover Counties. In Amherst County, feldspar is marketed as aggregate at the Piney River Quarry of the W.W. Boxley Company, Blue Ridge Stone Corporation. They produced 418,772 tons of feldspar during 1998. The company stockpiles the fines that result from the crushing of the feldspar. In the past, feldspar was mined from several pegmatite bodies in the Piedmont province. These pegmatite bodies occur in Amelia and Bedford Counties.

U.S. Silica Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia to produce a feldspar-rich material marketed as "Virginia Aplite." They produced about 191,758 tons of feldspar during 1998. Medium- to coarse-grained meta-anorthosite is mined by open pit methods to produce feldspar. The rock is trucked to the plant next to the mine for crushing, grinding, classifying, and drying. After processing, the feldspar is stored in silos. Gravity concentration removes clay minerals. Electrostatic and magnetic processes remove the heavy minerals (ilmenite, rutile, and sphene) in the feldspar. These minerals contain titanium and were stockpiled until the early 1980s, but are currently being placed in setting ponds. The material is sold to the glass industry. The "aplite" improves the work-ability of the molten glass and imparts a chemical stability to the finished glassware. The processed aplite is transported by truck and rail to markets in New Jersey, Pennsylvania, Ohio, Indiana, and Virginia.

Clay and silt, with a high percentage of kaolinite and mica, have accumulated in setting ponds at the Feldspar Corporation operation in Hanover County. About 75,000 to 100,000 tons of this material are added to settling ponds per year. The waste "tailings" were evaluated in the mid-1960s and were found suitable for use in face brick and drain tile; the material fires dark brown to gray.

GEMSTONES

In 1998, mineral collectors and the mining operation in Virginia produced 82 tons of blue-green amazonstone, beryl, topaz, tantalite, tourmaline, and zircon from this pegmatite natural gemstones. The Morefield pegmatite, operated as the Morefield Gem Mine in Amelia County, is open to the public for collecting on a fee basis.

GYPSUM

U.S. Gypsum Company operates an underground mine and plant at Locust Cove, Smyth County in southwestern Virginia and a processing plant in Norfolk in the eastern part of the state. They produced 329,437 short tons of gypsum during 1998. The Locust Cove Mine is a slope-entry, multilevel operation. Isolated masses of gypsum in the Maccrady Formation are mined by a modified stoping system. After initial crushing through a primary crusher, the gypsum is trucked to their processing plant at Plasterco, near Saltville, in adjacent Washington County. At Plasterco, the gypsum is ground into "land plaster" ($CaSO_4 + 2H_2O$). The material is calcined to remove the water and produce

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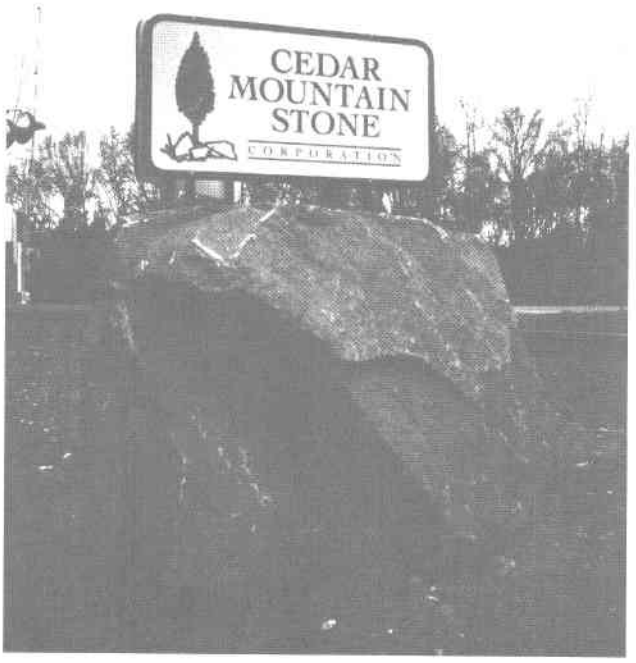

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U.S. Silica Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia to produce a feldspar-rich material marketed as "Virginia Aplite." They produced about 191,758 tons of feldspar during 1998. Medium- to coarse-grained meta-anorthosite is mined by open pit methods to produce feldspar. The rock is trucked to the plant next to the mine for crushing, grinding, classifying, and drying. After processing, the feldspar is stored in silos. Gravity concentration removes clay minerals. Electrostatic and magnetic processes remove the heavy minerals (ilmenite, rutile, and sphene) in the feldspar. These minerals contain titanium and were stockpiled until the early 1980s, but are currently being placed in setting ponds. The material is sold to the glass industry. The "aplite" improves the work-ability of the molten glass and imparts a chemical stability to the finished glassware. The processed aplite is transported by truck and rail to markets in New Jersey, Pennsylvania, Ohio, Indiana, and Virginia.

Clay and silt, with a high percentage of kaolinite and mica, have accumulated in setting ponds at the Feldspar Corporation operation in Hanover County. About 75,000 to 100,000 tons of this material are added to settling ponds per year. The waste "tailings" were evaluated in the mid-1960s and were found suitable for use in face brick and drain tile; the material fires dark brown to gray.

GEMSTONES

In 1998, mineral collectors and the mining operation in Virginia produced 82 tons of blue-green amazonstone, beryl, topaz, tantalite, tourmaline, and zircon from this pegmatite natural gemstones. The Morefield pegmatite, operated as the Morefield Gem Mine in Amelia County, is open to the public for collecting on a fee basis.

GYPSUM

U.S. Gypsum Company operates an underground mine and plant at Locust Cove, Smyth County in southwestern Virginia and a processing plant in Norfolk in the eastern part of the state. They produced 329,437 short tons of gypsum during 1998. The Locust Cove Mine is a slope-entry, multilevel operation. Isolated masses of gypsum in the Maccrady Formation are mined by a modified stoping system. After initial crushing through a primary crusher, the gypsum is trucked to their processing plant at Plasterco, near Saltville, in adjacent Washington County. At Plasterco, the gypsum is ground into "land plaster" ($CaSO_4 + 2H_2O$). The material is calcined to remove the water and produce

"stucco." Water is then added to the stucco with additional ingredients (sugar and starch) and poured, molded, and dried between sheets of paper to produce wallboard. Eighty-three kinds of wallboard are produced at Plasterco; average daily production at the plant could supply the needs in construction of 80 three-bedroom homes.

The Norfolk plant processes crude gypsum from Little Narrows and Windsor, Nova Scotia to produce wallboard and other gypsum-based products.The plant also produces fertilizer for the peanut industry. The Norfolk facility also receives a few shipments of anhydrite from Nova Scotia for sale to cement manufacturers. The anhydrite is used as a source of sulfur in producing cement clinker.

INDUSTRIAL SAND

Unimin Corporation produces glass sand near Gore in Frederick County. The glass sand is produced from the Ridgeley Sandstone of Devonian-age. CED Enterprises, in Frederick County, recrystallizes purchased sand in a rotary kiln to produce cristobalite. Cristobalite, which is sized and bagged on site, is marketed as fine grit, and used mainly as filler in paint and commercial casting molds. It is trucked to the Great Lakes area and to the western United States. Some is shipped overseas through the Port of Baltimore.

IRON-OXIDE PIGMENTS

Virginia is one of four states that produce pigments from natural iron oxide. Approximately 458 short tons of iron oxide was mined during 1998. Hoover Color Corporation, in Hiwassee, Pulaski County, produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Open pit methods are used to mine natural iron oxide from deposits. These deposits occur near the contact of the Erwin Formation with the overlying Shady Dolomite. Deposits, associated with gossans in Cambrian-age rocks, are concentrated as small bodies or pockets composed of insoluble clay and iron oxide. Precipitation from ground water also concentrates some iron oxide. The raw material is trucked to the plant at Hiwassee where it is pulverized, dried, ground, air separated, blended, and packaged before shipping. The finished product is used as a coloring agent in a variety of products. The largest market continues to be for paint; additional markets are art supplies (crayons, chalk, water colors) and building products (colored cinder blocks and bricks). The pigments are shipped throughout the United States, Canada, and Mexico. Virginia Earth Pigments Company mines a small quantity of iron oxide from the Brubaker #1 mine in southeastern Wythe County. The Hoover Color Corporation buys most of the material.

Blue Ridge Talc Co., Inc. located in Henry County, purchases iron oxide from Cleveland-Cliffs Iron Co. in Michigan. The company dries the pigment, pulverizes it, and sizes the material, which is marketed as a colorant for paint and cement and to the brick industry and the fertilizer industry.

KYANITE

Kyanite, an aluminum silicate, was first produced in Prince Edward County in the 1920s. Since September 1986, Virginia is the only state producing kyanite. Kyanite Mining Corporation produces most of the world's kyanite from its deposit in Buckingham County. The company produces a concentrate with a maximum of 61.8 percent alumina and a minimum iron content of 0.16 percent. The kyanite is converted to mullite by calcining at temperatures greater than 3000 degrees Fahrenheit. Mullite is a superduty refractory with a pyrometric cone equivalent of 36 to 37. Products, which are sold in 35, 48, 100, 200, and 325 mesh sizes, are used in the refractory, ceramic, glass, metallurgical, and foundry industries. Mullite aids ceramics and glass to resist cracking, warping, slagging, and deforming at high temperatures.

Kyanite Mining Corporation operates two surface mines and three processing plants in central Buckingham County. They produced 846,270 short tons of kyanite ore from two mines in 1998. The mines are located at Willis Mountain and at East Ridge. At the Willis Mountain and East Ridge mines, kyanite-bearing quartzite is quarried from open pits; this material is processed through primary crushers, a log washer to remove clay, on to classifiers to remove kyanite. The material then passes through a rod mill, which reduces it to a minus 35-mesh size, and through froth flotation cells where additional kyanite is skimmed off. The kyanite is dewatered and dried; the high temperature of the drier converts any iron sulfide minerals that are present to magnetic iron oxides. Pyrite is converted to ferrous iron oxide (Fe_3O_4) or magnetite, which is then removed by magnetic separators and stockpiled.

The Willis Mountain plant processes raw kyanite, some of which is trucked to East Ridge facility for calcining; the mullite product is ground and bagged at the company's Dillwyn Plant. Raw kyanite is ground and bagged at Willis Mountain.

Approximately 40 percent of the production is shipped through the port at Hampton Roads to customers worldwide. Most of the mullite and kyanite shipped from the port at Norfolk is destined for Japan, Korea, United Kingdom, Netherlands, Italy, and Australia. The company also markets sand as a by-product from the processing of kyanite. This sand is used for golf courses, masonry and concrete sand, and for applications such as sand for blasting.

LIME

Virginia's lime production, ranked ninth in the United States, is from six companies in Frederick, Giles, Shenandoah, and Warren Counties. Production in 1998 was 848,000 short tons valued at 49.5 million dollars (Figure 10). The paper industry uses lime for regeneration of sodium

hydroxide and for neutralization of sulphate water. Lime is used for water purification and in iron furnaces to remove impurities. During the last few years, lime has been used to neutralize acid mine water. It is also used for masons' lime, sewage treatment, and agriculture purposes. One important use is to abate the SO_2 and NO emissions from coal-fired boilers. Lime is presently supplied to several cogeneration coal-fired plants in southern Virginia. Two companies, in northwestern Virginia, W.S. Frey Company, Inc. and Chemstone Corporation quarry and calcine the high-calcium New Market Limestone. The Riverton Corporation, in Warren County, quarries and calcines limestone from the Edinburg Formation. Shenvalley Lime Corporation in Stephens City, Frederick County buys quicklime and produces a hydrated lime. APG Lime Corporation quarries and mines underground the high-calcium Five Oaks Limestone in eastern Giles County. The limestone is calcined in rotary kilns. Principal sales are to the paper and steel industries. APG Lime Corporation also markets lime kiln dust to neutralize and stabilize coal refuse from preparation plants in West Virginia.

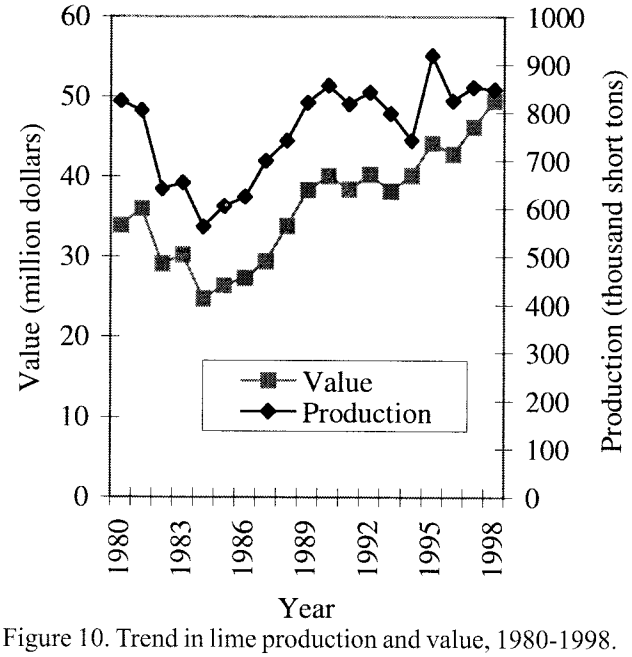

Figure 10. Trend in lime production and value, 1980-1998.

MANGANESE

Eveready Battery Company, Inc. operates a manganese processing facility in the City of Newport News. Manganese ore, imported from Ghana, Africa, and Mexico, is shipped to the Elizabeth River terminals in the City of Chesapeake. The ore is trucked to the processing plant. Manganese content and potential contaminants are monitored through continual chemical and mineralogical analysis. The manganese is dried in a gas-fired rotary kiln and crushed with jaw and ball crushers into two basic sizes. The ground product is shipped in bulk, bulk bags, or bags to plants in Iowa, Ohio, and North Carolina. The product is used in the manufacture of dry cell batteries.

MICA

Presently no domestic mica is being produced. In the past, it was produced from pegmatite bodies in several counties in Virginia, including Amelia, Henry, and Powhatan. Asheville Mica Company, an affiliate of the Mica Company of Canada, imports several grades of crude mica from Madagascar and India, then processes the mica in Newport News. The Asheville Mica Company also produces fabricated plate mica; Mica Company of Canada uses splittings from Asheville Mica Company to produce reconstituted plate mica. Plate mica is marketed for use in hair dryers and other electrical applications; reconstituted mica, composed of built-up mica plates, is used to manufacture mica washers for terminals and as shields in lithium batteries.

MINERAL SAND

In Dinwiddie, Greensville, and Sussex Counties, more than 8.8 million short tons of heavy mineral sands have been discovered. Large acreages remain under lease by RGC (USA) Mineral Sands, Inc.-Virginia. Ilmenite, leucoxene, rutile, and zircon make up nearly 80 percent of the heavy-mineral concentrate.

RGC continued producing heavy minerals, from the Old Hickory deposit near Bolsters Store in Dinwiddie County (Figure 11). Concentrated material is trucked to their plant

Figure 11. Mineral sand pit of RGC(USA) Mineral Sands, Inc., Dinwiddie County

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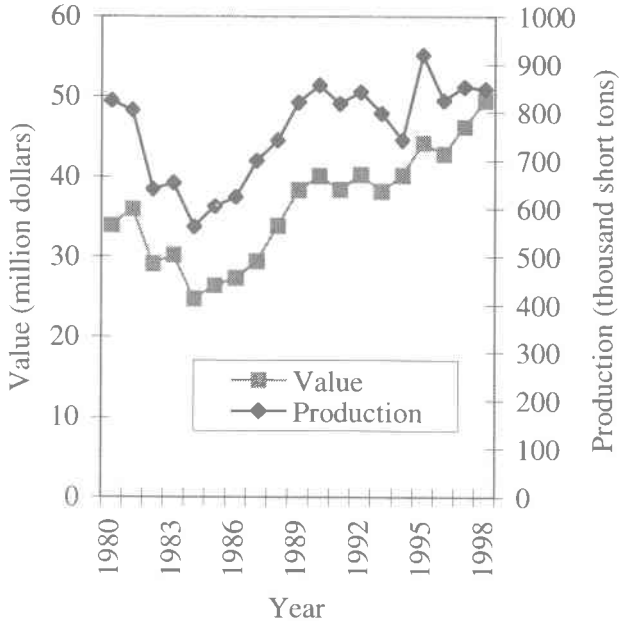

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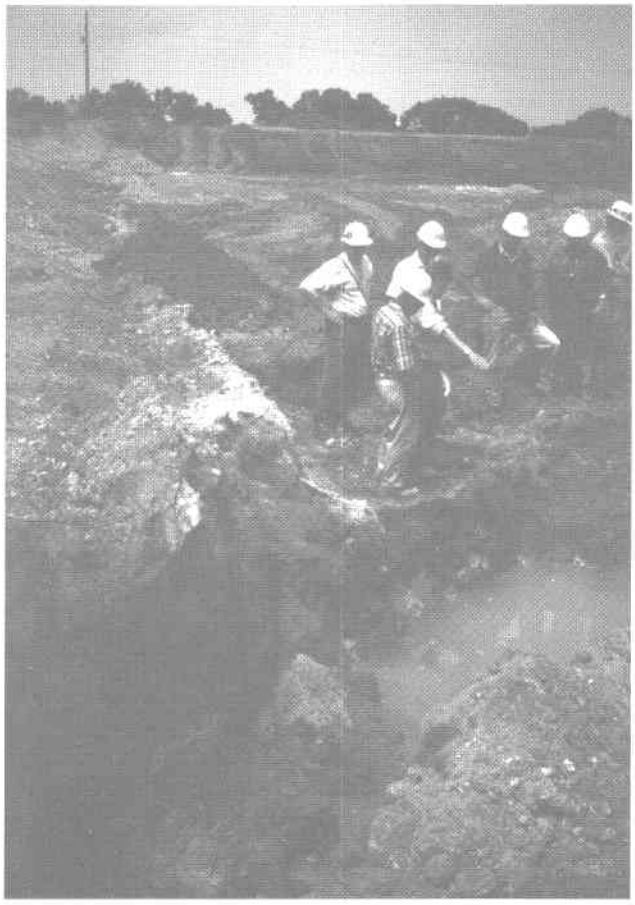

Figure 11. Mineral sand pit of RGC(USA) Mineral Sands, Inc., Dinwiddie County

near Stony Creek in adjacent Sussex County for final processing and shipment. Production of titanium-bearing minerals during 1998 was 187,893 short tons.

ORNAMENTAL AGGREGATE

Dolostone and quartzite from Botetourt and Rockbridge Counties are marketed as exposed-aggregate materials. Rock materials, such as black limestone (Edinburg Formation) from the Valley and Ridge province and greenstone from the Piedmont province, have been used as aggregate for terrazzo. Exposiac Industries, Inc. in Spotsylvania County uses a variety of rock materials for exposed panels, including greenstone from Albemarle County and Triassic-age sandstone from Culpeper County.

Many rock types have been used in the past for ornamental aggregate. Vein quartz was quarried in Albemarle, Buckingham, Fauquier, Fluvanna, Greene, and Rappahannock Counties, and quartz pebbles were extracted from floodplain deposits along the Mattaponi River in Caroline County.

PERLITE

Manville Sales Corporation operates a plant at Woodstock in Shenandoah County to expand perlite (volcanic glass with high water content and "onion" skin appearance) obtained from Taos, New Mexico. Raw material is trucked north from Taos County to the railhead at Antonito, Colorado, where it is loaded and shipped by rail to Virginia. Expanded perlite is used in manufacture of roof insulation board, which is marketed throughout the eastern United States.

PHOSPHATE ROCK

PCS Phosphate (formerly Texas Gulf, Inc.) ships phosphate rock by rail from its Lee Creek operation in North Carolina to Glade Spring, Washington County. It is then transported by truck to the PCS Phosphate plant in Saltville, Smyth County. A coal-fired rotary kiln is used to defluorinate the phosphate rock. The product is marketed as poultry and animal feed supplement in southern and midwestern states.

SULFUR

Amoco Oil Company operates a crude oil refinery near Yorktown. They recover elemental sulfur from hydrogen sulfide gas during crude oil refining. During the refining process, within the fluid catalytic cracking unit, hydrogen sulfide gas is formed. The hydrogen sulfide gas is converted to elemental sulfur using the modified-Claus process. In this process the hydrogen sulfide gas is heated in a combustion chamber and fed under pressure into a cylinder where it vaporizes. The gas is then fed into a condenser where it is cooled to form a liquid. An in-line acid-gas burner reheats the total gas stream and is then fed into a catalytic converter where more hydrogen sulfide gas reacts with sulfur dioxide to produce sulfur and water vapor. Sulfur vapor is then passed through another condenser and scrubber. The elemental sulfur is marketed for production of sulfuric acid, mainly at E.I. DuPont Company in Richmond, Virginia. The sulfuric acid is then used in the manufacture of chemicals, dyes, paints, and other products.

VERMICULITE

Virginia is one of two states that mine vermiculite, a hydrated magnesium-iron-aluminum silicate. Virginia Vermiculite, Ltd. operates an open-pit mine and processing facility near Boswells Tavern in Louisa County. The vermiculite is mined with a backhoe and a front-end loader and trucked to the adjacent plant where pieces greater than four inches across are removed. These pieces are washed and processed in a rod mill to shear the vermiculite into thin platelets. Biotite, feldspar, and other impurities are further concentrated and removed by froth flotation. The vermiculite is then dewatered, dried in a kiln, and screened to produce four basic sized products. Most of the crude vermiculite is shipped by rail in unexfoliated form to North Carolina, Ohio, West Virginia, other eastern states, and North Dakota.

FUEL COMMODITIES

Mineral fuels were produced in seven southwestern Virginia counties in 1998. The combined value of all fuel commodities sold in 1998 was 1,015.79-million dollars. Coal production for 1998 was 33,998,529 short tons. In 1998, 134 companies operated 352 coal-mining operations. Forty-two of the 134 companies produced coal from 261 operations. These 42 companies produced 17,254,960 short tons, or 51.1 percent of the total production. The value of coal produced in 1998 was about 883.96-million dollars.

Oil production for 1998 was 9646.11 barrels. Natural gas production during 1998 amounted to 55,467,822 Mcf. In 1998, 9 companies operated 61 oil wells and 18 companies operated 2,063 gas wells. The value of oil produced in 1998 was 154,916 dollars and natural gas was 124.80-million dollars.

COAL

Coal production in Virginia increased from 33.7-million short tons in 1997 to 33.9-million short tons in 1998 (Table 1; Figure 12). Forty-one coal beds were mined in the southwest Virginia coalfield in 1998. These coals occur in the Appalachian Plateaus province. The coals are contained in the Pennsylvanian-age Wise, Norton, Norton-Lee-New River, and Pocahontas Formations. The highest stratigraphically mined coal bed was the High Splint of the Wise Formation (11,663 short tons) in western Wise County (Table 5). Coal mined from the Wise Formation accounted for 41.25 percent. The Norton and Norton-Lee-New River coal mined accounted for 37.18 percent. Coal mined from the Pocahontas Formation accounted for 21.57 percent. The

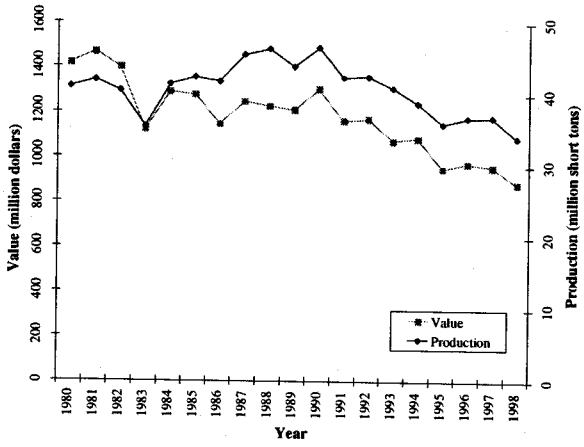

Figure 12. Trend in coal production and value, 1980-1998.

Pocahontas No. 3 coal was the most extensively mined bed, followed by the Jawbone, Norton, Splash Dam, and Low Splint coal beds. Coal produced from these five beds constituted 44.6 percent of the total 1998 production. Surface mined coal amounted to 8,038,490 short tons (Table 11). The amount of coal mined in the greater than 36-inch category was 19,269,343 short tons or about 56.6 percent of 1998 production. Coal in the less than 36-inch category amounted to 6,690,695 short tons or about 19.7 percent. Coal was produced from 349 surface and underground mines in Buchanan, Dickenson, Lee, Russell, Tazewell, and Wise Counties (Table 7). Total production from 252 underground mines was 25,959,091 short tons and from 98 surface mines were 8,0441,881 short tons. In underground mining, continuous miners mined 74.1 percent of the coal and longwall mining produced 24.5 percent; conventional mining in 1998 produced 1.4 percent of the coal. In surface operations, 4.7 percent of the coal was auger mined, and 95.3 percent was mined by conventional surface methods. Total value was $883.96-million; estimated mine price was $26.00 per short ton.

The total average annual employment reported in 1998 was 5,955 employees; 5,715 of these were production employees (Table 7). Production employees worked an average of 227 days producing coal in 1998. The average annual wage earned by all production employees was $33,179, based on those employees for whom wages were reported. The average annual wage for surface-mine production employees was $30,124, and the average annual wage for underground production employees was $33,956. Wages earned by all production employees totaled $189,622,874 in 1998.

Coal from Virginia is used for metallurgical purposes, electrical power generation (steam coal), industrial purposes, and residential heating. Most Virginia coal is exported through ports at Hampton Roads, Virginia and at Wilmington, North Carolina to overseas markets.

OIL AND GAS

Permitting Activity

The Department of Mines, Minerals and Energy, Division of Gas and Oil, issued 467 permits in 1998, a decrease of 7.3 percent from 1997. Of these, 309 permits (Table 12) were issued to drill new coalbed methane wells, 15 for conversion of mine vertical ventilation holes to coalbed methane wells, 43 permits were for new conventional and shale gas wells, 5 for dual completion wells, 3 for facilities construction, and 76 permits were for new pipeline construction. The remaining 16 permits were for plugging operations. Consol, Inc. was issued 116 permits to drill 116 new coalbed methane wells, followed by Equitable Production Company with 71 and Pocahontas Gas Partnership 65. New conventional and shale gas well permits were issued to Cabot Oil and Gas Company (8), Columbia Natural Resources (12), and Equitable Resources Energy Company (17). Coalbed methane well permitting was highest in Buchanan County at 62.8 percent followed by Tazewell County at 18.4 percent, Dickenson County at 13.9 percent, Wise County at 4.5 percent, and Russell at 0.4 percent. Conventional and shale gas well permitting was highest in Wise County at 39.5 percent followed by Buchanan County at 27.9 percent.

Drilling and Completion Activity

In 1998, 276 holes were drilled in Virginia (Table 12). Of the 276 holes drilled, 30 were for conventional and shale gas, 242 were for coalbed methane, and four were for dual completion. The county with the most active natural gas and coalbed methane wells drilled was Buchanan with 155, followed by Dickenson with 48, Tazewell with 47, and Wise with 27. One well was drilled in Russell County during 1998. Total footage drilled in 1998 was 667,693 feet (Table 13), a decrease from the 672,357 feet drilled in 1997. Of the 1998 total footage, 147,243 feet were for conventional and shale gas wells, 503,982 feet were for coalbed methane wells, and 16,468 feet were for dual completion. In 1998, the average conventional and shale gas well was drilled 4908 feet and drilling depth for coalbed methane was 2082 feet.

Two hundred and thirty-five wells were completed in 1998. Of the 235 wells completed for production 27 were for conventional and shale gas, 205 for coalbed methane, 3 for dual completion. Completion zones ranged from the Pennsylvanian Pocahontas Formation to the Mississippian-Devonian Chattanooga Shale. Location coordinates for the wells drilled or completed during 1998 can be obtained from the Division of Gas and Oil in Abingdon.

Buchanan County

Coalbed methane wells: One Hundred and forty-eight coalbed methane wells were drilled in 1998. Total develo-

ment footage drilled in 1998 was 298,333 feet. One exploratory well was drilled with a total footage of 1945 feet. Consol, Inc. drilled 84 development wells during 1998 with total footage of 195,986 feet; average footage drilled 1980 feet. Equitable Resources Energy Company drilled 10 development wells with a total footage of 34,628 feet; average footage drilled 2473 feet. Pocahontas Gas Partnership drilled 54 development wells with a total footage drilled of 212,507 feet; average footage drilled 1986 feet.

One hundred and ten coalbed methane wells were completed during 1998 with a total footage of 333,456 feet; average depth 1961 feet. Of these 110 wells, Consol, Inc. completed 39 development wells with a total footage of 176,100 feet; average depth of 1978 feet. Equitable Resources Energy Company completed 14 coalbed methane wells with a total footage of 21,317 feet; average depth of 2132 feet. Pocahontas Gas Partnership completed 57 development wells with a total footage of 132,661 feet; average depth of 1895 feet. Completion zones in the Consol, Inc., Pocahontas Gas Partnership, and Equitable Resources Energy Company wells are the coal beds and associated strata in the Pennsylvanian Pocahontas and Lee Formations. Additionally, 14 coalbed methane wells were plugged and abandoned. Consol, Inc. plugged and abandoned 10 wells. Island Creek Coal Company plugged and abandoned four wells during 1998.

Conventional and shale gas wells: Columbia Natural Resources drilled and completed six conventional and shale gas wells in 1998. All the wells are in the Breaks-Haysi gas field. Total footage drilled was 13,868 feet; average depth 4623 feet. All wells were drilled into the Mississippian-Devonian Chattanooga Shale. Producing formations in the two wells are the Chattanooga Shale, Berea Sandstone, and Greenbrier Limestone.

Dual completion wells: Equitable Resources Energy Company drilled one well for production of coalbed methane and conventional and shale gas. Total footage drilled for this dual completion was 6,500 feet.

Dickenson County

Coalbed Methane wells: Forty coalbed methane wells were drilled and completed by Equitable Resources Energy Company in 1998 with a total footage of 89,602 feet; average depth 2240 feet. The wells were drilled into the Pennsylvanian Pocahontas Formation. All the wells are located in the Nora gas field. Gas production from the wells is by commingling of gas from coal beds and associated strata in the Pocahontas and Lee Formations.

Conventional and shale gas wells: Equitable Resources Energy Company drilled two conventional and shale gas wells in the Nora gas field in 1998. Total footage drilled was 13,868 feet; average depth 4623 feet. Columbia Natural Resources drilled six conventional and shale gas wells in the Breaks-Haysi gas field. All wells were drilled into the Mississippian-Devonian Chattanooga Shale. Producing formations in the two wells are the Chattanooga Shale, Berea Sandstone, and Greenbrier Limestone.

Dual completion wells: Equitable Resources Energy Company completed one well for production of coalbed methane and conventional and shale gas. Total footage drilled for dual completions was 10,750 feet; average footage drilled 5375 feet.

Highland County

Conventional and shale gas wells: Cabot Oil and Gas Company plugged and abandoned two wells during 1998. The intended-producing zone in the two wells was the Ridgeley Sandstone.

Russell County

Coalbed methane wells: Equitable Resources Energy Company drilled and completed one coalbed methane well during 1998. The well was completed in the Skeen Creek gas field. Total footage drilled in the well was 2395 feet. Production comes from commingling of gas associated with coal beds and associated strata in the Pocahontas and Lee Formations.

Tazewell County

Coalbed methane wells: A new development in Tazewell County during 1998 was the development of coalbed methane resources along the axis of the Dry Fork anticline in southern Jewell Ridge quadrangle. Pocahontas Gas Partnership drilled 46 wells for coalbed methane development during 1998. Forty-three of these wells were completed during 1998. Total footage drilled for coalbed methane was 94,094 feet. Production comes from commingling of gas associated with coal beds and associated strata in the Pocahontas and Lee Formations.

Conventional and shale gas wells: Cabot Oil and Gas Company drilled and completed one development well in the Berwind gas field in 1998. Total footage drilled was 5713 feet. The well is producing from the Mississippian Berea Sandstone bed of the Chattanooga Shale.

Wise County

Coalbed methane wells: Equitable Resources Energy Company drilled 9 coalbed methane wells in 1998. They completed eleven wells. Total footage drilled was 19,558 feet; average depth 2173 feet. Producing zones in the eleven wells are the coal beds and associated strata in the Pocahontas and Lee Formations.

Conventional and shale gas wells: Equitable Resources Energy Company drilled 13 and completed 11 conventional and shale gas wells. Total footage drilled in the county was 64,289 feet; average depth was 4945 feet. Dominion Appalachian Development, Inc. drilled and completed two wells in the Roaring Fork gas field. Formation at total depth in all the wells is the Devonian-Mississippian Chattanooga Shale.

Dual completion wells: Equitable Resources Energy Company drilled three wells for production of coalbed methane and conventional and shale gas. Total footage drilled was 11,461 feet; average footage drilled was 3820 feet. They also completed two dual completion wells during 1998.

Production

Crude oil production in Virginia totaled 9,646 barrels in 1998, which was a 6.6 percent decrease from the 1997 production of 10,337 barrels (Figure 13). Oil production is from the Ben Hur-Fleenortown and Rose Hill oil fields in the Valley and Ridge province and the Roaring Fork and one unnamed gas field in the Appalachian Plateaus province. Production was by nine companies from 61 wells (Table 11) in the Ben Hur-Fleenortown and Rose Hill oil fields in Lee County (3,878.61 barrels) and the Roaring Fork gas field in western Wise County (5,767.50 barrels). Fifteen wells in the Ben Hur-Fleenortown oil field yielded 2593.89 barrels of oil; average 14.41 barrels per well per month. One well in the Rose Hill oil field yielded 1284.72 barrels of oil. Forty-five wells in the Roaring Fork gas field-averaged 10.68 barrels per month. Oil in Virginia comes from the Ordovician Trenton Limestone in Lee County and the Mississippian Greenbrier Limestone in Wise County. The value of oil produced in 1998 was $154,916; estimated unit value was $16.06 per barrel.

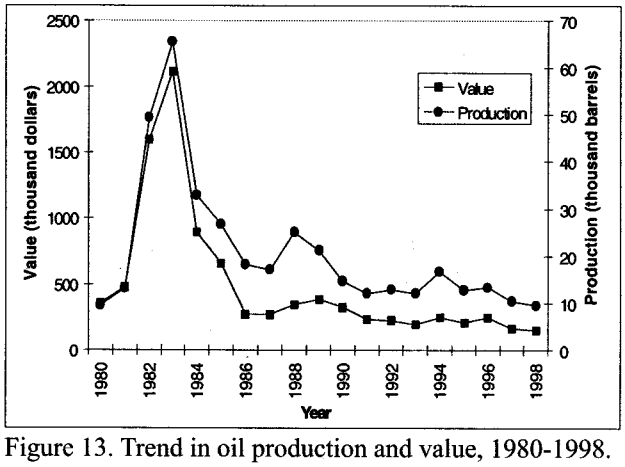

Figure 13. Trend in oil production and value, 1980-1998.

Natural gas production decreased, from 58,246,751 Mcf in 1997 from 2018 wells to 55,467,822 Mcf in 1998 from 2063 wells (Table 12; Figure 14). Conventional and shale gas produced was 16,642,974 Mcf from 998 wells; 28.6 percent of the total production. Coalbed methane produced was 38,492,081 Mcf from 1054 wells; 71.4 percent of the total natural gas production in the Commonwealth. Average daily gas production from conventional and shale gas wells was 45.7 Mcf. Coalbed methane wells averaged 100.1 Mcf per day. Natural gas production came from Buchanan County (33,286,881 Mcf), Dickenson County (12,972,617 Mcf), Lee County (3,204 Mcf), Russell County (437,186 Mcf), Scott County (25,147 Mcf), Tazewell County (713,087 Mcf) and Wise County (8,029,700 Mcf). The average price paid to Virginia's natural gas producers in 1998 was $2.25 per Mcf. The market value for Virginia's natural gas was $124,802.600, a decrease of 26.8 percent from 1997.

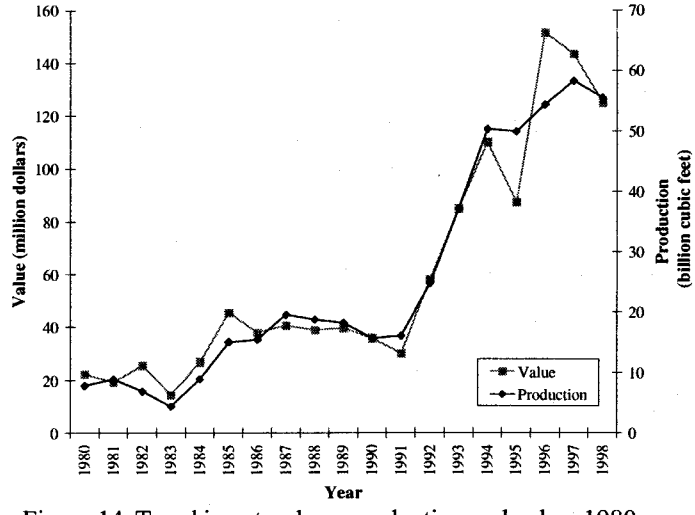

Figure 14. Trend in natural gas production and value, 1980-1998.

GRAPHS AND DATA SOURCES

Graphs provided within the text are designed only to show trends in value and production of mineral commodities and should not be used to obtain exact values for sales or production. Values used to generate the graphs may be obtained from the Division of Mineral Resources at the following number, 804-951-6362.

Data in Tables 2 through 4 were obtained from the Division of Mineral Mining, Tables 5 through 8 from the Division of Mines, and Tables 9 through 13 from the Division of Gas and Oil.

Table 2. Metal/nonmetal production by county/city and commodity, 1998.

County/City	Basalt and Traprock	Clay	Diabase	Diorite	Dolostone	Feldspar	Fullers Earth	Granite	Gravel	Greenstone	Gypsum
Albemarle	866,817	0	0	0	0	0	0	422,000	0	0	0
Amherst	0	71,196	0	0	0	418,772	0	0	0	0	0
Botetourt	0	163,532	0	0	0	0	0	0	0	0	0
Brunswick	0	0	0	0	0	0	0	2,725,301	0	0	0
Campbell	0	0	0	0	0	0	0	0	0	410,493	0
Caroline	0	0	0	0	0	0	0	32,000	0	0	0
Chesterfield	0	0	0	0	0	0	0	1,916,300	0	0	0
Culpeper	0	0	536,589	0	0	0	0	4,101	0	0	0
Dinwiddie	0	0	0	0	0	0	0	1,627,500	0	0	0
Fairfax	2,266,790	0	0	0	0	0	0	1,773,042	0	0	0
Fauquier	610,236	0	0	0	0	0	0	473,538	0	0	0
Franklin	0	0	0	0	0	0	0	310,400	0	0	0
Goochland	0	0	0	0	0	0	0	4,330,170	0	0	0
Grayson	0	0	0	0	0	0	0	568,980	0	0	0
Greene	0	0	0	0	0	0	0	715,906	0	0	0
Greensville	0	0	0	0	0	0	0	1,621,537	0	0	0
Halifax	0	0	0	0	0	0	0	1,085,077	0	0	0
Hanover	0	15,000	0	0	0	191,758	0	2,028,000	22,155	0	0
Henrico	0	0	0	0	0	0	0	1,064,973	2,100	0	0
Henry	0	0	0	411,580	0	0	0	699,457	0	0	0
King and Queen	0	0	0	0	0	0	56,943	0	0	0	0
King William	0	0	0	0	0	0	137,628	0	0	0	0
Loudoun	6,748,558	0	0	0	0	0	0	0	0	0	0
Louisa	0	0	0	0	0	0	0	344,521	0	0	0
Mecklenburg	0	0	0	0	0	0	0	972,156	0	0	0
Northumberland	0	0	0	0	0	0	0	0	1,850	0	0
Nottoway	0	0	0	0	0	0	0	595,630	0	0	0
Powhatan	0	0	0	0	0	0	0	853,526	0	0	0
Prince George	0	28,889	0	0	0	0	0	0	0	0	0
Prince William	2,504,809	0	0	0	0	0	0	0	0	0	0
Richmond	0	0	0	0	0	0	0	2,879,862	0	0	0
Roanoke	0	0	0	0	1,517,635	0	0	0	0	0	0
Rockbridge	0	0	0	0	280,422	0	0	0	0	0	0
Rockingham	0	41,987	0	0	0	0	0	0	0	0	0
Smyth	0	0	0	0	0	0	0	0	0	0	329,437
Spotsylvania	0	0	0	0	0	0	0	1,020,000	21,518	0	0
Stafford	0	0	0	0	0	0	0	1,578,056	0	0	0
Warren	0	0	0	0	0	0	0	0	22,698	0	0
Total	**12,997,210**	**320,604**	**536,589**	**411,580**	**1,798,057**	**610,530**	**194,571**	**29,642,033**	**70,321**	**410,493**	**329,437**

Table 2. (continued) Metal/nonmetal production by county/city and commodity, 1998.

County/City	Iron Oxide Pigment	Kyanite	Limestone	Quartzite	Sand	Sand and Gravel	Sandstone	Shale	Slate	Vermiculite
Accomack	0	0	0	0	94,891	0	0	0	0	0
Albemarle	0	0	0	0	0	600	0	0	0	0
Alleghany	0	0	348,886	0	0	0	0	0	0	0
Amelia	0	0	0	0	0	174,984	0	0	0	0
Amherst	0	0	0	0	250	0	0	0	0	0
Appomattox	0	0	324,177	0	0	0	0	0	0	0
Augusta	0	0	938,368	0	77,405	34,885	218,500	0	0	0
Bath	0	0	0	0	0	0	0	1,250	0	0
Bedford	0	0	1,029,777	0	21,753	14,200	0	0	0	0
Bland	0	0	244,117	0	0	0	0	0	0	0
Botetourt	0	0	2,077,045	0	0	0	0	0	0	0
Brunswick	0	0	0	0	0	0	0	92,808	0	0
Buckingham	0	846,270	0	0	0	0	0	0	295,162	0
Campbell	0	0	1,287,910	0	27,755	0	0	0	0	0
Caroline	0	0	0	0	0	496,156	0	0	0	0
Charles City	0	0	0	0	10	760,752	0	0	0	0
Charlotte	0	0	0	0	10,072	0	0	0	0	0
Chesapeake(City)	0	0	0	0	1,022,478	0	0	0	0	0
Chesterfield	0	0	0	0	3,100	0	0	0	0	0
Clarke	0	0	164,319	0	0	0	0	2,780	0	0
Craig	0	0	0	0	143,315	0	0	0	0	0
Culpeper	0	0	0	0	0	0	582,000	0	0	0
Danville(City)	0	0	0	0	41,237	0	0	0	0	0
Essex	0	0	0	0	225	7,350	0	0	0	0
Fauquier	0	0	0	0	0	0	136	0	0	0
Fluvanna	0	0	0	0	3,526	0	0	0	0	0
Frederick	0	0	1,310,578	401,009	1,422	0	0	26,902	0	0
Giles	0	0	1,055,851	0	0	0	0	0	0	0
Gloucester	0	0	0	0	10,010	349,649	0	0	0	0
Grayson	0	0	0	0	8,399	0	0	0	0	0
Greensville	0	0	0	0	0	183,138	0	92,808	0	0
Halifax	0	0	0	0	14,659	0	0	0	0	0
Hampton(City)	0	0	0	0	50,161	0	0	0	0	0
Hanover	0	0	0	0	129,560	116,856	0	0	0	0
Henrico	0	0	0	0	0	1,911,849	0	0	0	0
Henry	0	0	0	0	14,854	0	0	0	0	0
Highland	0	0	45,782	0	0	0	0	0	0	0
Isle of Wight	0	0	0	0	887,497	0	0	0	0	0

Table 2. (continued) Metal/nonmetal production by county/city and commodity, 1998.

County/City	Iron Oxide Pigment	Kyanite	Limestone	Quartzite	Sand	Sand and Gravel	Sandstone	Shale	Slate	Vermiculite
James City	0	0	0	0	347,341	0	0	0	0	0
King and Queen	0	0	0	0	25,200	163,047	0	0	0	0
King George	0	0	0	0	0	1,377,498	0	0	0	0
King William	0	0	0	0	790	677,102	0	0	0	0
Lancaster	0	0	0	0	10,880	14,338	0	0	0	0
Lee	0	0	685,855	0	0	0	9,000	0	0	0
Louisa	0	0	0	0	0	0	0	0	0	46,121
Mathews	0	0	0	0	6,400	16,952	0	0	0	0
Mecklenburg	0	0	0	0	850	0	0	0	0	0
Middlesex	0	0	0	0	71,032	0	0	0	0	0
Montgomery	0	0	1,892,133	0	0	0	0	0	0	0
Nelson	0	0	0	0	0	810	0	0	0	0
New Kent	0	0	0	0	0	54,662	0	0	0	0
Northampton	0	0	0	0	16,959	0	0	0	0	0
Northumberland	0	0	0	0	11,147	2,630	0	0	0	0
Orange	0	0	0	0	0	0	0	95,264	0	0
Page	0	0	0	0	0	0	0	800	0	0
Pittsylvania	0	0	0	0	75,726	0	0	0	308,288	0
Prince George	0	0	0	0	16,188	1,333,100	0	0	0	0
Prince William	0	0	0	0	0	0	0	103,428	0	0
Pulaski	341	0	587,350	0	0	0	0	0	0	0
Richmond	0	0	0	0	13,378	0	0	0	0	0
Roanoke	0	0	0	0	0	0	0	103,602	0	0
Rockbridge	0	0	264,700	0	0	0	0	0	0	0
Rockingham	0	0	1,734,380	0	0	260,034	0	55,276	0	0
Russell	0	0	1,912,799	0	0	0	0	0	0	0
Scott	0	0	570,251	0	0	0	0	94,374	0	0
Shenandoah	0	0	3,008,380	0	500	0	0	1,405	0	0
Smyth	0	0	55,956	0	2,250	0	0	0	0	0
Southampton	0	0	0	0	196,907	42,955	0	0	0	0
Spotsylvania	0	0	0	0	0	570,200	0	0	0	0
Stafford	0	0	0	0	0	476,248	0	0	0	0
Suffolk(City)	0	0	0	0	87,860	54,910	0	0	0	0
Surry	0	0	0	0	1,635	38	0	0	0	0
Sussex	0	0	0	0	0	22,041	0	0	0	0
Tazewell	0	0	1,242,575	0	0	0	0	0	0	0
Virginia Beach (City)	0	0	0	0	1,516,703	0	0	0	0	0
Warren	0	0	420,469	0	0	0	0	0	0	0
Washington	0	0	885,398	0	0	0	0	0	0	0
Westmoreland	0	0	0	0	91,008	5,189	0	0	0	0
Wise	0	0	465,399	0	0	0	0	0	0	0
Wythe	117	0	779,454	761,127	154,140	0	163,754	153,088	0	0
York	0	0	0	0	5,175	0	0	0	0	0
Total	**458**	**846,270**	**23,331,910**	**1,162,136**	**5,214,647**	**9,122,171**	**973,390**	**823,785**	**603,450**	**46,121**

Table 3. Summary of metal/nonmetal mining by commodity, 1998.

Commodity	Tonnage (short tons)	Office Workers	Office Hours	Office Wages	Production Workers	Production Hours	Production Wages
Basalt/Traprock	12,997,210	50	114,128	$2,268,306	276	777,848	$10,367,423
Clay	458,231	32	46,012	$956,047	104	146,109	$1,845,929
Diabase	536,589	3	4,159	$51,292	36	46,852	$557,826
Diorite	411,580	10	12,741	$216,561	34	57,068	$699,265
Dolostone	1,798,057	15	30,797	$1,032,389	77	113,377	$1,663,309
feldspar	610,530	7	13,915	$306,424	40	89,821	$1,253,912
fullers earth	56,943	8	12,821	$227,465	55	81,705	$925,224
gemstones	82	1	1,500	$4,000	1	1,500	$4,000
gold	0	1	120	$1,200	2	480	$4,800
granite	29,642,033	70	175,399	$2,610,169	649	1,742,966	$25,190,872
gravel	70,321	9	103	$783	15	1,707	$21,701
greenstone	410,493	4	7,101	$100,100	14	25,596	$335,404
gypsum	329,437	3	6,240	$101,517	43	107,400	$1,906,135
iron oxide	117	0	0	$0	0	16	$2,920
kyanite	846,270	24	44,295	$2,279,360	148	163,832	$4,365,409
limestone	23,331,910	223	455,207	$8,212,237	1,360	2,680,244	$36,256,543
limonite	341	11	21,600	$623,443	27	63,341	$799,380
marl	8,345	1	243	$4,778	1	207	$2,740
quartz	8,207	1	1	$16	2	784	$8,130
quartzite	1,162,136	5	11,028	$196,470	50	113,542	$1,673,685
sand	5,214,647	109	58,465	$967,608	367	214,516	$2,556,663
sand & clay	100	0	0	$0	2	10	$200
sand and gravel	9,122,171	81	89,011	$1,431,433	384	618,090	$7,908,238
sandstone	973,390	6	6,418	$92,419	28	63,979	$1,375,564
shale	823,785	14	1,217	$24,178	18	31,550	$516,605
slate	603,450	17	33,865	$443,079	263	329,423	$3,425,461
soapstone	18	2	800	$10,000	4	1,467	$13,118
titanium	187,893	19	31,907	$299,228	60	106,741	$1,763,028
vermiculite	46,121	7	11,380	$220,172	27	50,062	$630,012
Total	**89,650,408**	**733**	**1,190,473**	**$22,680,674**	**4,087**	**7,630,233**	**$106,073,496**

Table 4. Summary of metal/nonmetal mining by county/city, 1998.

County/City	Tonnage (short tons)	Office Workers	Office Hours	Office Wages	Production Workers	Production Hours	Production Wages
Accomack	94,891	7	1,279	$7,200	18	5,615	$48,934
Albemarle	1,289,435	8	10,096	$126,770	37	79,403	$1,321,424
Alleghany	348,886	1	3,038	$32,193	4	35,691	$101,660
Amelia	175,066	2	3,986	$27,910	7	12,529	$144,484
Amherst	490,218	3	1,968	$36,452	22	39,599	$472,811
Appomattox	324,177	3	8,303	$154,779	17	37,993	$389,101
Augusta	1,269,158	11	21,389	$259,034	72	119,691	$1,463,774
Bath	1,250	0	0	$0	1	35	$375
Bedford	1,073,937	9	9,718	$156,980	51	101,152	$1,328,107
Bland	244,117	1	2,080	$30,597	13	22,015	$290,252
Botetourt	2,240,577	50	93,995	$2,454,131	247	487,594	$9,021,913
Brunswick	2,818,109	6	8,837	$105,338	47	177,792	$2,094,541
Buckingham	1,141,432	36	66,632	$2,539,662	356	401,622	$6,602,782
Campbell	1,726,158	12	15,695	$232,549	55	103,554	$1,335,024
Caroline	528,156	8	4,205	$133,022	27	13,588	$392,495
Charles City	760,762	6	5,897	$140,581	37	46,225	$516,297
Charlotte	10,072	1	48	$384	5	1,973	$16,277
Cheaspeake(City)	1,022,478	9	8,353	$96,745	96	45,749	$493,005
Chesterfield	1,919,400	4	14,288	$157,240	37	101,665	$1,846,515
Clarke	167,099	2	2,516	$28,317	12	23,765	$251,086
Craig	143,315	1	2,888	$16,992	3	14,040	$144,133
Culpeper	1,122,690	6	8,959	$119,292	49	96,321	$1,775,902
Danville(City)	41,237	0	0	$0	0	4,303	$42,243
Dinwiddle	1,815,393	22	38,423	$430,547	88	182,917	$2,985,509
Essex	7,575	2	25	$260	3	70	$7,560
Fairfax	4,039,832	9	21,108	$313,555	78	195,774	$3,020,304
Fauquier	1,083,910	5	11,828	$185,918	31	68,554	$977,392
Fluvanna	3,526	0	0	$0	2	418	$8,136
Franklin	310,400	4	4	$40	18	29,067	$392,758
Frederick	1,739,911	29	50,976	$886,484	197	146,738	$3,507,540
Giles	1,055,851	13	25,900	$497,753	159	340,727	$3,893,752
Gloucester	359,659	8	4,797	$68,200	16	22,313	$349,126
Goochland	4,330,170	11	25,528	$361,186	81	210,264	$3,087,794
Grayson	577,379	3	5,205	$45,857	32	64,697	$713,099
Greene	715,906	3	7,200	$124,014	18	49,607	$640,464
Greensville	1,897,483	5	7,593	$87,031	33	129,639	$1,582,419
Halifax	1,099,736	3	6,852	$85,863	26	73,709	$891,512
Hampton(City)	50,161	0	0	$0	2	4,286	$52,748
Hanover	2,503,329	19	26,992	$541,702	87	176,686	$3,218,852
Henrico	2,978,922	16	24,552	$458,475	78	184,999	$2,235,940
Henry	1,125,892	16	19,465	$351,356	65	109,539	$1,304,461
Highland	45,782	2	2,474	$28,088	4	6,292	$59,445
Isle of Wight	895,842	14	17,827	$307,146	19	18,944	$330,443
James City	347,341	1	43	$2,584	14	8,421	$100,510
King and Queen	245,190	11	17,446	$277,631	77	101,077	$1,102,010
King George	1,377,498	5	8,164	$89,052	32	46,780	$610,410
King William	815,519	33	59,391	$1,195,561	113	201,608	$2,989,660
Lancaster	25,218	7	165	$1,451	34	1,023	$13,917
Lee	694,855	5	10,816	$140,731	32	61,425	$668,105
Loudoun	6,748,559	37	78,951	$1,749,797	155	455,716	$5,621,596

Table 4. (continued) Summary of metal/nonmetal mining by county/city, 1998.

County/City	Tonnage (short tons)	Office Workers	Office Hours	Office Wages	Production Workers	Production Hours	Production Wages
Louisa	390,642	8	13,780	$250,459	45	84,959	$1,065,612
Mathews	23,452	2	128	$640	5	445	$4,550
Mecklenburg	973,006	3	5,787	$52,891	24	70,445	$753,457
Middlesex	71,032	5	85	$677	10	3,286	$35,316
Montgomery	1,892,133	9	18,613	$218,443	51	122,749	$1,462,551
Nelson	810	2	11	$118	1	65	$650
New Kent	54,662	2	2,101	$27,734	7	5,320	$55,502
Northampton	16,959	1	400	$4,000	5	1,677	$13,430
Nothumberland	15,627	3	28	$216	14	11,135	$121,351
Nottoway	595,630	2	4,800	$61,468	16	42,196	$545,035
Orange	95,264	1	200	$2,747	0	1,772	$25,863
Page	800	0	0	$0	4	100	$800
Pittsylvania	384,014	14	12,554	$198,903	63	78,749	$993,000
Powhatan	853,526	3	7,200	$97,084	17	38,340	$546,843
Prince Edward	0	1	1,548	$17,777	11	22,260	$297,672
Prince George	1,378,177	4	6,993	$113,837	38	92,841	$1,300,976
Prince William	2,608,237	5	11,593	$158,147	56	151,950	$2,316,077
Pulaski	587,691	14	28,282	$693,571	47	109,491	$1,297,415
Richmond(City)	2,879,862	7	15,304	$327,189	46	139,854	$1,941,867
Richmond	13,378	4	46	$420	7	544	$6,345
Roanoke	1,621,237	12	24,960	$974,063	72	111,021	$1,704,833
Rockbridge	545,122	5	8,060	$81,728	23	36,552	$388,858
Rockingham	2,091,677	24	28,136	$295,607	92	135,810	$1,594,515
Russell	1,912,799	19	42,276	$652,984	108	269,334	$2,422,006
Scott	664,625	5	9,401	$120,547	30	38,940	$537,420
Shenandoah	3,010,285	33	67,003	$1,457,459	116	275,333	$3,372,003
Smyth	387,643	3	6,240	$101,517	50	113,027	$1,952,851
Southampton	239,862	6	3,038	$26,132	36	23,066	$250,163
Spotsylvania	1,611,718	10	10,429	$159,135	49	106,978	$1,735,649
Stafford	2,054,304	6	10,199	$126,967	36	95,328	$1,431,131
Suffolk(City)	142,770	4	2,148	$13,217	6	6,426	$66,767
Surry	1,673	0	0	$0	1	154	$1,540
Sussex	22,041	2	588	$2,880	9	10,192	$89,581
Tazewell	1,242,575	9	20,514	$404,857	57	122,086	$1,679,995
Virginia Beach (City)	1,516,703	9	13,401	$399,627	27	18,469	$319,556
Warren	443,167	5	6,441	$68,073	64	153,075	$2,290,181
Washington	885,398	3	8,489	$72,966	28	35,290	$608,852
Westmoreland	96,197	1	2,250	$19,350	3	3,055	$40,999
Wise	465,399	1	2,819	$29,595	11	18,788	$312,444
Wythe	2,011,680	15	28,353	$358,159	94	215,168	$2,413,448
York	5,175	2	380	$3,040	1	759	$8,223
Total	**89,650,408**	**733**	**1,190,473**	**$22,680,674**	**4087**	**7,630,233**	**$106,463,924**

Table 5. Coal mine production in Virginia by county and coal bed, 1998.

Formation/ Coal Bed	Production (short tons) Buchanan	Dickenson	Lee	Russell	Tazewell	Wise	Total
Wise	**1,364,212**	**734,303**	**1,310,632**	**0**	**0**	**10,608,275**	**14,017,422**
High Splint	0	0	0	0	0	11,663	11,663
Morris	0	0	0	0	0	272,206	272,206
Pardee	0	0	0	0	0	937,774	937,774
Wax	0	0	0	0	0	102,156	102,156
Gin Creek	0	0	0	0	0	87,906	87,906
Phillips	0	0	707,727	0	0	331,125	1,038,852
Jackrock	0	0	0	0	0	27,826	27,826
Little Red	0	0	0	0	0	18,275	18,275
House	0	0	0	0	0	65,303	65,303
Low Splint	0	0	0	0	0	1,420,901	1,420,901
34 inch	0	0	0	0	0	23,970	23,970
Owl	0	0	0	0	0	76,131	76,131
Taggart	0	0	161,361	0	0	677,317	838,678
Taggart Marker	0	0	0	0	0	329,544	329,544
Wilson	0	0	283,451	0	0	1,062,262	1,345,713
Pinhook	0	0	0	0	0	336,256	336,256
Kelly	0	0	0	0	0	1,103,151	1,103,151
Imboden	25,740	0	158,093	0	0	1,197,067	1,380,900
Clintwood	215,131	443,933	0	0	0	788,390	1,447,455
Clintwood Marker	0	338	0	0	0	89,903	90,241
Blair	705,220	0	0	0	0	721,473	1,426,693
Blair Marker	0	0	0	0	0	1,971	1,971
Lyons	389,111	172,665	0	0	0	498,495	1,060,271
Dorchester	29,009	117,367	0	0	0	427,209	573,585
Norton	**2,192,155**	**2,487,559**	**0**	**714,755**	**0**	**2,039,237**	**7,433,706**
Norton	0	379,610	0	0	0	1,528,346	1,907,956
Hagy	386,128	83,866	0	0	0	267,645	737,639
Splash Dam	1,138,171	619,864	0	2,973	0	0	1,761,008
Upper Banner	0	546,176	0	369,382	0	222,352	1,137,910
Lower Banner	0	858,044	0	52,932	0	8,443	919,419
Kennedy	667,856	0	0	289,468	0	0	957,324
Aily	0	0	0	0	0	12,451	12,451
Norton/New River	**1,289,629**	**453,243**	**0**	**528,539**	**2,047,831**	**954,466**	**5,273,708**
Raven	595,546	60,884	0	0	17,526	0	673,957
Jawbone	694,083	392,359	0	528,539	0	954,466	2,569,446
Tiller	0	0	0	0	470,245	0	470,245
Greasy Creek	0	0	0	0	242,006	0	242,006
Lower Seaboard	0	0	0	0	230,539	0	230,539
Upper Horsepen	0	0	0	0	719,549	0	719,549
Lower Horsepen	0		0	0	259,256	0	259,256
Pocahontas No. 8	0		0	0	108,710	0	108,710
Pocahontas	**7,242,989**	**0**	**0**	**0**	**34,086**	**0**	**7,277,075**
Pocahontas No. 5	0	0	0	0	34,086	0	34,086
Pocahontas No. 3	7,242,989	0	0	0	0	0	7,242,989

Table 6. Coal mine production in Virginia by county and thickness category, 1998.

Formation/ Coal Bed	Production (short tons) Surface Strip	Underground <36"	Underground >36"	Total
Wise	**6,813,607**	**2,683,109**	**4,520,704**	**14,017,420**
High Splint	0	11,663	0	11,663
Morris	0	0	272,206	272,206
Pardee	444,235	0	493,538	937,774
Wax	102,156	0	0	102,156
Gin Creek	87,906	0	0	87,906
Phillips	11,656	0	1,027,196	1,038,852
Jackrock	27,826	0	0	27,826
Little Red	18,275	0	0	18,275
House	65,303	0	0	65,303
Low Splint	59,071	0	1,361,830	1,420,901
34 inch	23,970	0	0	23,970
Owl	76,131	0	0	76,131
Taggart	571,603	0	267,074	838,678
Taggart Marker	201,757	127,786	0	329,543
Wilson	327,672	823,341	194,700	1,345,713
Pinhook	336,256	0	0	336,256
Kelly	264,768	258,566	579,817	1,103,151
Imboden	501,636	879,264	0	1,380,900
Clintwood	1,447,454	0	0	1,447,454
Clintwood Marker	90,241	0	0	90,241
Blair	724,656	487,899	214,137	1,426,692
Blair Marker	1,971	0	0	1,971
Lyons	1,060,272	0	0	1,060,272
Dorchester	368,792	94,589	110,205	573,585
	6,813,607			
Norton	**1,109,067**	**3,053,765**	**3,270,874**	**7,433,706**
Norton	11,614	887,463	1,008,879	1,907,956
Hagy	100,780	534,276	102,583	737,639
Splash Dam	74,617	663,040	1,023,351	1,761,008
Upper Banner	844,302	19,472	274,135	1,137,909
Lower Banner	64,021	437,006	418,393	919,419
Kennedy	1,283	512,509	443,532	957,324
Aily	12,451	0	0	12,451
Norton/New River	**119,197**	**953,821**	**4,200,690**	**5,273,708**
Raven	0	613,072	60,884	673,957
Jawbone	119,197	154,614	2,295,635	2,569,446
Tiller	0	60,476	409,769	470,245
Greasy Creek	0	0	242,006	242,006
Lower Seaboard	0	16,949	213,590	230,539
Upper Horsepen	0	0	719,549	719,549
Lower Horsepen	0	0	259,257	259,257
Pocahontas No. 8	0	108,710	0	108,710
Pocahontas	**0**	**0**	**7,277,075**	**7,227,075**
Pocahontas No. 5	0	0	34,086	34,086
Pocahontas No. 3	0	0	7,242,989	7,242,989

Table 7. Coal mine production in Virginia by county and mining method, 1998.

County	All Methods (short tons)	Total number of mines	Number of underground mines	Underground Production (short tons) Total underground	Longwall	Continuous miner	Number of Surface mines	Surface Production (short tons) Total Surface	Strip	auger
Buchanan	12,088,984	134	117	11,004,890	6,359,061	4,613,091	17	1,084,094	989,289	94,805
Dickenson	3,675,106	46	27	2,556,656	0	2,495,771	19	1,118,450	1,042,054	76,396
Lee	1,310,632	19	12	1,127,107	0	1,115,831	7	183,525	170,872	12,653
Russell	1,243,296	13	9	818,008	0	818,008	4	425,288	423,352	1,935
Tazewell	2,081,917	34	34	2,081,917	0	2,081,917	0	0	0	0
Wise	13,601,974	106	53	8,371,461	0	8,112,894	53	5,230,515	5,031,137	199,377
Total	**34,001,909**	**352**	**252**	**25,960,039**	**6,359,061**	**19,237,512**	**100**	**8,041,872**	**7,656,704**	**385,166**

Table 8. Coal mine employment and wages in Virginia by county and mining method, 1998.

	Buchanan	Dickenson	Lee	Russell	Tazewell	Wise	Total
Employees	**1,979**	**794**	**358**	**225**	**433**	**2,253**	**6,041**
Production							
Auger	29	28	7	4	0	43	111
Strip	120	185	48	52	0	716	1,121
Surface Total	149	213	55	56	0	759	1,232
Underground Total	1,752	567	295	163	413	1,377	4,567
Total	**1,901**	**780**	**350**	**219**	**413**	**2,136**	**5,799**
Office							
Auger	1	4	0	0	0	1	5
Strip	1	3	0	3	0	50	57
Surface Total	2	7	0	3	0	51	62
Underground Total	76	7	8	3	20	66	180
Total	**78**	**14**	**8**	**6**	**20**	**117**	**242**
Man Days							
Auger	1,054	618	218	60	0	1,212	3,162
Strip	2,214	2,556	832	1,200	0	9,492	16,294
Surface Total	3,268	3,174	1,050	1,260	0	10,704	19,456
Underground Total	20,170	8,016	3,058	2,340	4,892	15,234	53,710
Total	**23,438**	**11,190**	**4,108**	**3,600**	**4,892**	**25,938**	**73,166**
Man Hours							
Auger	29,630	10,611	2,200	1,080	0	28,855	72,376
Strip	246,640	292,004	64,569	115,757	0	1,506,388	2,225,358
Surface Total	276,270	302,615	66,769	116,655	0	1,535,243	2,297,552
Underground Total	3,190,805	1,031,839	471,941	276,632	674,224	2,562,751	8,208,192
Total	**3,467,075**	**1,334,454**	**538,710**	**393,287**	**674,224**	**4,097,994**	**10,505,744**
Wages	**$73,397,828**	**$26,370,813**	**$10,363,348**	**$8,813,119**	**$13,491,143**	**$68,144,203**	**$200,580,454**
Production							
Auger	$313,475	$95,031	$19,263	$7,560	$0	$311,064	$746,393
Strip	$4,830,697	$5,193,305	$770,772	$2,616,156	$0	$22,055,996	$35,466,926
Surface Total	$5,144,172	$5,288,336	$790,035	$2,623,716	$0	$22,367,060	$36,213,319
Underground Total	$65,055,252	$20,918,260	$9,320,899	$6,165,143	$12,633,980	$40,645,489	$154,739,023
Total	**$70,199,424**	**$26,206,596**	**$10,110,934**	**$8,788,859**	**$12,633,980**	**$63,012,549**	**$190,952,342**
Office							
Auger	$0	$250	$0	$0	$0	$2,293	$2,543
Strip	$21,602	$64,968	$0	$12,500	$0	$2,215,667	$2,314,737
Surface Total	$21,602	$65,218	$0	$12,500	$0	$2,217,960	$2,317,280
Underground Total	$3,176,802	$98,999	$252,414	$11,760	$857,163	$2,913,694	$7,310,832
Total	**$3,198,404**	**$164,217**	**$252,414**	**$24,260**	**$857,163**	**$5,131,654**	**$9,628,112**

Table 9. New permits issued for oil and gas operations by category, 1998.

County/ Operator	Coalbed Methane	Coalbed Coversion	Gas	Gas/Coalbed Methane	Plugging	Facilities	Pipeline	Total
Buchanan	**194**	**15**	**12**	**2**	**15**	**0**	**15**	**253**
Cabot Oil & Gas	0	0	4	0	0	0	2	6
Cardinal States	0	0	0	0	0	0	1	1
Columbia Natural Resources	0	0	7	0	0	0	0	7
Consol, Inc.	116	15	1	0	12	0	0	144
Island Creek Coal Co.	0	0	0	0	3	0	0	3
Equitable Production Co.	13	0	0	1	0	0	11	25
Pocahontas Gas Partnership	65	0	0	1	0	0	1	67
Dickenson	**43**	**0**	**10**	**2**	**0**	**1**	**36**	**92**
Columbia Natural Resources	0	0	5	0	0	0	1	6
Equitable Production Co.	43	0	5	2	0	1	35	86
Highland	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
Cabot Oil & Gas	0	0	0	0	1	0	0	1
Lee	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
Evan Energy Co.	0	0	0	0	0	0	2	2
Russell	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**
Equitable Production Co.	1	0	0	0	0	0	2	3
Tazewell	**57**	**0**	**4**	**0**	**0**	**1**	**1**	**63**
Cabot Oil & Gas	0	0	4	0	0	0	1	5
Pocahontas Gas Partnership	57	0	0	0	0	1	0	58
Wise	**14**	**0**	**17**	**1**	**0**	**1**	**20**	**53**
Dominion Appalachian Dev.	0	0	5	0	0	0	1	6
Equitable Production Co.	14	0	12	1	0	1	19	47
Total	**309**	**15**	**43**	**5**	**16**	**3**	**76**	**467**

Table 10. Drilling and completion activity by well type and county, 1998.

County	Wells Drilled				Wells Completed							
	Gas	Coalbed Methane	Dual Completion	Total	Gas	Coalbed Methane	Dual Completion	Total	Gas	Coalbed Methane	Dual Completion	Total
Buchanan	**6**	**148**	**1**	**155**	**6**	**110**	**0**	**116**	**0**	**14**	**0**	**14**
Columbia Natural Resources	6	0	0	6	6	0	0	6	0	0	0	0
Consol, Inc.	0	84	0	84	0	39	0	39	0	10	0	10
Equitable Production Company	0	10	1	11	0	14	0	14	0	0	0	0
Island Creek Coal Company	0	0	0	0	0	0	0	0	0	4	0	4
Pocahontas Gas Partnership	0	54	0	54	0	57	0	57	0	0	0	0
Dickenson	**8**	**40**	**0**	**48**	**7**	**40**	**1**	**48**	0	**0**	**0**	**0**
Columbia Natural Resources	6	0	0	6	5	0	0	5	0	0	0	0
Equitable Production Company	2	40	0	42	2	40	1	43	0	0	0	0
Highland	0	0	0	0	0	0	0	0	**2**	**0**	**0**	**2**
Cabot Oil & Gas	0	0	0	0	0	0	0	0	2	0	0	2
Russell	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**
Equitable Production Company	0	1	0	1	0	1	0	1	0	0	0	0
Tazewell	**1**	**46**	**0**	**47**	**1**	**43**	**0**	**44**	**0**	**0**	**0**	**0**
Cabot Oil & Gas	1	0	0	1	1	0	0	1	0	0	0	0
Pocahontas Gas Partnership	0	46	0	46	0	43	0	43	0	0	0	0
Wise	**15**	**9**	**3**	**27**	**13**	**10**	**4**	**27**	**0**	**0**	**0**	**0**
Dominion Appalachian Dev., Inc.	2	0	0	2	2	0	0	2	0	0	0	0

Table 11. Total footage drilled for natural gas by well type and county, 1998.

County	Footage Drilled				
	Exploratory Coalbed Methane	Development Gas		Dual Completion	Total Footage
Buchanan	1,945	296,388	36,381	2,910	337,624
Dickenson	0	89,602	40,860	2,097	132,559
Russell	0	2,395	0	0	2,395
Tazewell	0	94,094	5,713	0	99,807
Wise	0	19,558	64,289	11,461	95,308
Total	**1,945**	**502,037**	**147,243**	**16,468**	**667,693**

Table 12. Oil production by county and company, 1998.

County	Field Company	Number of Producing Wells	Volume (Barrels)
Lee	**Ben Hur-Fleenortown Oil**	**15**	**2,593.89**
	APACO Oil and Gas Co.	5	265.59
	Ben Hur Oil Co.	5	805.00
	Eastern States Oil and Gas, Inc	1	679.00
	Evan Energy Co., LC	2	276.00
	United Well Services, Inc.	1	408.30
	Witt Oil Drilling	1	160.00
	Rose Hill Oil	**1**	**1,284.72**
	Pride Oil Co.	1	1,284.72
	Roaring Fork Gas	**45**	**5,767.50**
Lee	Amvest Oil and Gas Co.	1	10.00
Wise	Equitable Production Co.	44	5,757.50
State Total		**61**	**9,646.11**

Table 13. Natural gas production by county and company, 1998.

County	Company	Number of Producing Wells	Volume (Mcf)
Buchanan	**Conventional and shale gas**	**201**	**2,644,045**
	Blazer Energy Corporation	48	927,724
	Cabot Oil & Gas Corporation	9	68,294
	Columbia Natural Resources	99	1,236,160
	Eastern American Energy Corp.	4	44,983
	Peake Energy Co.	1	23,413
	Penn Virginia Oil & Gas	2	13,177
	Pocahontas Gas Partnership	2	19,986
	Virginia Gas Co.	36	310,308
	Coalbed Methane	**635**	**30,627,452**
	Consol, Inc.	304	17,011,734
	Equitable Production Co.	28	863,913
	Island Creek Coal Co.	30	842,434
	Pocahontas Gas Partnership	270	11,844,707
	Ratliff Gas Co.	1	1,668
	Virginia Gas Co.	2	62,996
	Dual Completion	**2**	**15,384**
	Equitable Production Co.	2	15,384
Buchanan Total		**838**	**33,286,881**
Dickenson	**Conventional and shale ga**	**419**	**6,428,695**
	Columbia Natural Resources	33	511,044
	Elliott Production	2	20,901
	Equitable Production Co.	350	5,093,276
	Pine Mountain Oil & Gas	8	116,458
	Virginia Gas Co.	26	687,016
	Coalbed Methane	**304**	**6,461,155**
	Equitable Production Co.	304	6,390,646
	Dual Completion	**4**	**82,767**
	Equitable Production Co.	4	82,767
Dickenson Total		**727**	**12,972,617**
Lee	**Conventional and shale gas**	**1**	**3,204**
	Amvest Oil & Gas Co.	1	3,204
Lee Total		**1**	**3,204**
Russell	**Conventional and shale gas**	**1**	**7,717**
	Pine Mountain Oil & Gas	1	7,717
	Coalbed Methane	**30**	**429,469**
	Equitable Production Co.	30	429,469
Russell Total		**31**	**437,186**

Table 13. (continued) Natural gas production by county and company, 1998.

County	Company	Number of Producing Wells	Volume (Mcf)
Scott	**Conventional and shale gas**	**2**	**25,147**
	Equitable Production Co.	2	25,147
Scott Total		**2**	**25,147**
Tazewell	**Conventional and shale gas**	**37**	**637,020**
	Cabot Oil & Gas Corporation	24	444,530
	CNG Producing	2	4,071
	Columbia Natural Resources	6	110,034
	Dominion Appalachian Develop.	2	31,375
	Exploration Partners, Inc.	1	24,812
	R & B Petroelum, Inc.	2	22,198
	Coalbed Methane	**36**	**76,067**
	Pocahontas Gas Partnership	36	76,067
Tazewell Total		**73**	**713,087**
Wise	**Conventional and shale gas**	**337**	**6,897,146**
	Amvest Oil & Gas Co.	6	17,629
	Equitable Production Co.	331	6,879,517
	Coalbed Methane	**49**	**897,938**
	Equitable Production Co.	49	897,938
	Dual Completion	**5**	**234,616**
	Equitable Production Co.	5	234,616
Wise Total		**391**	**8,029,700**
SUBTOTAL	**Conventional and shale gas**	**998**	**16,642,974**
	Coalbed Methane	**1,054**	**38,492,081**
	Dual Completion	**11**	**332,767**
STATE TOTAL		**2,063**	**55,467,822**